The Buyers' Perspective on Security Design: Hedge Funds and Convertible Bond Call Provisions

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20 January 2017

Abstract

We provide evidence that security design reflects the interplay of capital supplier and security issuer preferences. While call provisions have historically been the default option in convertible security design, only a minority of post-2005 issues are callable. Because hedge funds dominate the market for new convertibles today and because convertible arbitrage is less risky without callability, the recent diminution in the frequency of call provisions in new convertible bond issues illustrates the importance of the preferences of the suppliers of capital in security design.

JEL classification: G2, G32

Keywords: Security design, supply of capital, call provisions, convertibles, hedge funds

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1. Introduction

Many studies consider optimal security design from the viewpoint of the issuer. It can be argued that issuers design securities to minimize the costs associated with agency problems (Harris and Raviv, 1989), with information asymmetries (Duffie and Rahi, 1995), and with financial distress, regulation and taxation (Miller, 1986; Myers, 2001). Several recent studies of corporate financial decisions take the viewpoint of the supplier of capital. Baker (2009) reviews the evidence that supplier preferences are a determinant of corporate financial decisions and identifies supplier-driven security design as an important topic for future research in corporate finance.

Our paper investigates the importance of supplier-driven security design and does so by addressing the interplay of both supplier and issuer preferences. We examine a market that has witnessed a major shift in the identity of the suppliers of capital, namely the market for convertible securities. The convertible market is especially interesting as the shift in the supply side is both observable and towards a supplier with particular design preferences, namely convertible arbitrage hedge funds. Importantly, the issuer and the hedge fund perspectives can differ substantially on the question of whether or not to include a call provision.[1] Consequently, we focus on the fluctuating popularity of convertible call provisions to examine the interplay of supplier and issuer preferences in the design of securities.

Traditional rationales for why firms issue convertibles take the issuer's perspective and assign substantial importance to call provisions. The models of Stein (1992) and Mayers (1998) were developed at a time when call provisions were the norm. The information asymmetry rationale of Stein (1992) posits that high-quality firms issue debt, low-quality firms issue

[1] A call provision allows the issuer to redeem the convertible before its maturity. Upon calling, the holder of the convertible is forced to choose between the call price and converting the bond into a specified number of shares.

equity, and medium-quality firms issue convertibles. Call provisions are important in Stein's "backdoor equity" rationale for convertible issuance since they allow a firm to force conversion once the share price has risen. In Mayers (1998), convertibles are issued for sequential financing purposes and call provisions are important as they allow firms whose sequential investment option proves valuable to reduce their leverage by forcing conversion.

Also from the issuer's perspective, the inclusion of call provisions in debt issues (both convertible and straight issues) has also been explained as a reflection of agency problems (Bodie and Taggart, 1978; Barnea, Haugen, and Senbet, 1980; Robbins and Schatzberg, 1986); the result of bond issuers' desire to hedge against decreases in interest rates (Bowlin, 1966; Pye, 1966); and as a means of avoiding hold-up problems by removing undesired covenants that restrict merger activity (Smith and Warner, 1979).

Now consider the preferences of the suppliers of capital. The principal buyers of convertibles today are hedge funds.[2] Hedge funds combine the purchase of a convertible with a short position in the firm's stock. Calamos (2003), a practitioner text, observes that convertible arbitrage strategies are easier to implement when a convertible is not callable. The uncertainty introduced by a call provision complicates hedging by making it more difficult to determine the optimal number of shares to short and complicates the detection of arbitrage opportunities due to the additional knowledge of the firm's call policy that is required when valuing the convertible. Similarly, Woodson (2002) argues that (p. 131) "the hedge arbitrageur does not want to be exposed to the risk of forced conversion." Importantly, an unanticipated call redistributes wealth from the holders of convertibles to stockholders. Such a redistribution is not a hedgeable comovement of the bond and stock. In the event of a call, convertible

[2] See Mitchell, Pedersen, and Pulvino (2007), Choi, Getmansky, and Tookes (2009), and Brown, Grundy, Lewis, and Verwijmeren (2012).

arbitrage hedge funds lose both on their long position in the convertible and on their short position in the issuer's stock.

Korkeamaki and Moore (2004) report that 98% of all convertibles issued between 1980 and 1996 contain call provisions. We confirm that the large majority of the convertibles in our sample that are issued before 2000 do contain call provisions. If hedge fund preferences are an important determinant of the design of convertible securities today, then the inclusion of call provisions in convertible debt should have decreased in recent years. Indeed, the growth of the convertible arbitrage industry after 2000 has been accompanied by a rapid decrease in the popularity of convertible bond call provisions. Less than 40% of the convertibles issued in the final year of our sample period (in 2013) are callable and since 2003 less than 20% of new convertible issues have been callable within the first three years of their lives.[3]

We document a negative relation between the size of the convertible arbitrage industry and the probability that a newly-issued convertible is callable.[4] We also examine the impact of the private placement market for convertibles on the likelihood of incorporating a call provision. Privately placing a security allows issuers and buyers to directly negotiate the design of the security and private placements have been particularly popular with convertible arbitrage hedge funds (Brown et al., 2012; Berkman, McKenzie, and Verwijmeren, 2017). Consistent

[3] We do not find a similar diminution in the likelihood that new straight debt issues are callable. Although many theoretical rationales for including call provisions apply to both convertibles and straight debt, the straight debt market is not dominated by hedge funds and hence the design of straight debt does not reflect the concerns of convertible arbitrageurs.

[4] Our focus on the relation between convertible arbitrage and call provisions is unique. Prior work on convertible arbitrage has focused on the relation to security mispricing (Mitchell, Pedersen and Pulvino, 2007), stock market liquidity (Choi, Getmansky, and Tookes, 2009), issue volume (Choi, Getmansky, Henderson, and Tookes, 2010; De Jong, Duca, and Dutordoir, 2013), stock repurchases (De Jong, Dutordoir, and Verwijmeren, 2011), the announcement effects of an issue (Duca, Dutordoir, Veld, and Verwijmeren, 2012), and the cost of raising capital (Brown et al., 2012).

with the preferences of hedge funds, privately-placed convertibles are significantly less likely to include call provisions than are publicly-issued convertibles.

We further examine the link between cross-sectional variation in hedge fund involvement and the decision to include a call provision. We collect hedge fund involvement in specific convertible issues and estimate regression models that include year fixed effects. We confirm the negative relation between hedge fund involvement and the probability that an issue is callable in this analysis.

The demand from convertible arbitrage hedge funds for call-protected convertibles is likely to affect the offering discounts associated with these convertible issues. Indeed, we find that the offering discount for call-protected convertibles is negatively related to the size of the convertible arbitrage industry, which suggests that issuers can offer a lower discount when the supply of capital is larger, in line with downward-sloping investor demand (Shleifer, 1986). For callable convertibles, the discounts are not as sensitive to the size of the convertible arbitrage industry.

Overall, our results establish the importance of the supply side of capital for security design.[5] In addition, we are the first to document the magnitude of the diminution in the

[5] Several papers examine the effect of capital supplier preferences on corporate financial decisions (Baker, 2009). Miller (1977) and Givoly, Hayn, Ofer, and Sarig (1992) demonstrate the link between the relative tax rates of security issuers and capital suppliers and the economy-wide level of debt. Graham (1999) investigates the separate effects of security issuer tax rates and capital supplier tax rates on capital structure choices. Baker and Wurgler (2004) conclude that firms are more likely to pay dividends in times of increased investor preferences for dividend-paying firms. Baker, Greenwood, and Wurgler (2009) conclude that firms supply shares at lower price levels when investors place higher valuations on low-price firms. The paper most closely related to our study of supplier effects on security design is Becker and Ivashina (2016), which ascribes the new popularity of covenant-light leveraged loans to the increasing role of non-bank institutions, such as mutual funds and hedge funds, as suppliers of capital. The authors' thesis is that creditor coordination costs resulting from shifts in the composition of institutional investors make covenants that can require renegotiation less attractive.

popularity of convertible call provisions. A further contribution of our study is that the recent diminution in the popularity of call provisions in convertible debt has provided sufficient cross-sectional variation in whether or not a convertible is callable to allow an analysis of the determinants of the issuer's desire to include a call provision in a new convertible security. This was not possible when call provisions were ubiquitous. We find evidence that in addition to the preferences of convertible arbitrageurs, other significant determinants of whether a convertible is callable are the opportunity that a call provision gives to (i) reduce problems associated with information asymmetries, (ii) facilitate sequential financing, and (iii) reduce hold-up problems.

The recent diminution in the likelihood that a convertible will be callable has implications for the current applicability of some of the rationales advanced for issuing convertibles. In particular, the backdoor equity rationale of Stein (1992) and the sequential financing rationale of Mayers (1998) both assume that the convertible is callable.[6] The reduction in the likelihood that a convertible will contain a call provision does not though imply that the backdoor equity and sequential investment opportunities rationales for convertible bond issuance are no longer relevant. Rather, short-term non-callable debt maturing after the resolution of an information asymmetry can be a substitute for callable long-term debt (Robbins and Schatzberg, 1986). We document that the average maturity of convertible bonds has been relatively short since the early 1990s.

[6] Other rationales for issuing convertibles are that convertibles can reduce risk-shifting incentives (Green, 1984); reduce the sensitivity of the value of a new debt issue to a change in the risk of the issuer's activities (Brennan and Kraus, 1987; Brennan and Schwartz, 1988); allow financing in the presence of an information asymmetry (Constantinides and Grundy, 1986); and provide the least-cost financing opportunity for firms with relatively high costs of issuing seasoned equity (Brown et al., 2012). The models of Green (1984), Brennan and Kraus (1987), Brennan and Schwartz (1988), Constantinides and Grundy (1986), and Brown et al. (2012) do not rely on the convertible being callable.

The paper is organized as follows. Section 2 discusses the growth of the convertible hedge fund industry. Section 3 describes the data and time trends in the callability of new issues of convertibles. Section 4 considers the traditional set of rationales for the inclusion of call provisions in both convertible and straight debt. Section 5 undertakes a logit analysis of convertible bond callability based on both the traditionally posited determinants of callability and the size of the convertible hedge fund industry. Section 6 highlights the link between callability and hedge fund involvement in specific convertible issues. Section 7 examines offering discounts. The implications of our findings for the backdoor equity and sequential financing rationales for issuing convertible bonds are explored in Section 8 and Section 9 concludes.

2. The rise of convertible arbitrage hedge funds

The decision to call a convertible bond rests with the issuing firm and redistributes wealth between convertibleholders and stockholders. An unanticipated call will result in a convertible hedge fund losing on both its long position (in the convertible) and its short position (in the common stock of the bond issuer). Although some non-academic sources mention (without quantifying) a change in the popularity of call provisions,[7] we have not been able to find evidence in these sources on the reason for the shift in call provisions. The practitioner texts of Woodson (2002) and Calamos (2003) and our conversations with practitioners suggest that convertible arbitrageurs can affect convertible security design. Interestingly, Thomson Reuters' International Financial Review, which describes the context for new security issues, provides the following comment on a GSI Commerce convertible issue in 2005: "There is no

[7] For example, a 2006 client alert by law firm Latham & Watkins reports that "Traditionally, converts had relatively limited call protection, permitting issuers to redeem the bonds", while "recent transactions have seen issuers forgoing some or all of this flexibility".

doubt that convertible bond buyers have leverage over issuers to set terms on new offerings. GSI commerce […] had to offer […] added investor protections in bringing its US$50m convertible bond."[8]

Growth in the convertible arbitrage market has been well documented. Calamos (2003) notes the increase in the size of the market after 2000. Choi, Getmansky, and Tookes (2009) document the increase by reporting the assets under management of convertible arbitrage hedge funds for each quarter between 1993 Q3 and 2006 Q2. Duca et al. (2012) report the number of news stories about convertible arbitrage in the Factiva database each year between 1984 and 2009. Not only are convertible arbitrageurs managing more money and receiving more publicity, they are purchasing a larger fraction of new issues of convertibles. Brown et al. (2012) examine the level of hedge fund involvement in a large set of privately-placed convertibles issued between 2000 and 2008. The average percentage of privately-placed convertibles purchased by hedge funds increased from approximately 60% in 2000 to approximately 85% in 2008. Fig. 1 shows the time trends in the Choi, Getmansky, and Tookes (2009), Duca et al. (2012), and Brown et al. (2012) measures of convertible arbitrage activity.

[please insert Fig. 1 here]

All three measures show a substantial increase after 2000. The total size of the assets under management in the convertible arbitrage industry does decrease in 2005, but this decrease does not reduce the level of hedge fund involvement in new issues. If the preferences of convertible arbitrage hedge funds are an important determinant of whether new issues of convertible bonds contain call provisions, then we expect a decline in the popularity of call

[8] Convertible arbitrage hedge funds such as Highbridge and Radcliffe were involved in the GSI Commerce offering, which was eventually issued with five years of call protection. An examination of these hedge funds' 13F filings shows that, consistent with the general finding in Van Marle and Verwijmeren (2016), both funds sold their positions long before the call protection period ended.

provisions in the 21st century relative to the past situation when hedge funds were not the dominant buyers of new convertible issues.

3. Data and time trends

3.1. Data

We collect data from the Mergent Fixed Investment Securities Database (Mergent FISD) on 4,568 U.S. convertible issues over the period January 1985 to July 2013.[9] After deleting instances where the apparent issue was simply the public registration of an earlier privately-placed convertible we are left with 3,520 new issues. The main sample that we examine is the subset of 2,479 issues of convertible bonds by industrial firms, i.e. we exclude issues by financial firms (566 observations), utilities (133 observations), firms with missing SIC codes (129 observations), and convertible preferred stock issues (213 observations).[10] When we require that Compustat reports information on the issuer in the year prior to issue we are left with our restricted sample of 1,853 issues of convertible bonds by industrial firms with Compustat data.

3.2. The changing frequency of convertible call provisions through time

The upper chart in Fig. 2 depicts the changing percentage of convertible bond issues with call provisions over time. The high percentage of convertibles with call provisions before 2000 is in line with the results of Korkeamaki and Moore (2004). Call provisions quickly lose their popularity early this century falling to 29% of our main sample in 2011. At the mid-2013 end of our sample period, 38% of convertible bond issues contain call provisions.[11] The percentages

[9] Mergent contains data on only a small number of convertible issues before 1985.

[10] The exclusion of these issues does not affect our conclusions.

[11] Our main sample contains 16 observations that do not have a regular call provision but do have a soft call provision. A soft call provision means that a call is only possible if the stock price exceeds the

for the restricted sample with Compustat information are virtually identical to those of the main sample.

[please insert Fig. 2 here]

The lower chart in Fig. 2 shows the percentage of convertible securities that can be called in the first three years of the bond's life. This measure is relevant for convertible arbitrageurs since hedge funds typically hold convertibles for only a limited amount of time and hence can be indifferent between non-callable convertibles and those that are call-protected for three years. Van Marle and Verwijmeren (2016) document that convertibles purchased by hedge funds are subsequently held by the purchasing hedge fund for an average of 11 months and that approximately 95% of purchasing hedge funds had closed their positions within three years.

Korkeamaki and Moore (2004) document that although a period of call protection was not uncommon for convertibles issued between 1980 and 1996, the majority of convertibles were callable in the first three years of their life. Only 18.8% of convertibles issued in the last decade of our sample period are callable within three years of issuance. The dramatic decline in the likelihood that new convertible bond issues are callable and in the likelihood that, if a new convertible is callable, it is callable during the first three years of its life is consistent with the preferences of convertible arbitrage hedge funds.

4. Traditional determinants of the incorporation of call provisions

Prior studies of the inclusion of call provisions have largely focused on straight debt. This section considers the factors identified in these studies and their potential importance as variables in our analysis of the call provisions in convertible bonds. Bowlin (1966) and Pye (1966) argue that interest rate variability is an important determinant of whether a bond will be

conversion price by a specified percentage for a specific number of days. Our conclusions are robust to excluding these observations and to classifying these issues as non-callable.

callable. A call provision allows the issuing firm to refinance its debt if interest rates fall and hence the inclusion of a call provision can be viewed as optimal when the firm's managers predict a higher likelihood of a decline in interest rates than is predicted by buyers of the firm's debt. If the disparity in predictions is larger when interest rates are higher, then call provisions will be more common when interest rates are high. Kish and Livingston (1992) and Banko and Zhou (2010) conclude that higher interest rates at the time of issue increase the probability that a straight debt issue will include a call provision.[12]

The Kish and Livingston (1992) and Banko and Zhou (2010) studies report that the popularity of call provisions in new issues of straight debt is also related to the percentage of below investment-grade bonds issued in a year. The authors argue that below investment-grade bond issuers are more likely to use call provisions to alleviate the more severe agency problems they face, as described in Bodie and Taggart (1978), Barnea, Haugen, and Senbet (1980), and Robbins and Schatzberg (1986). Managers can have private information on a firm's credit quality. Since there is more room for improvement for firms whose current ratings are poor, below investment-grade issues may be more likely to include call provisions. Crabbe and Helwege (1994) report that nearly all below investment-grade straight bonds are callable, while fewer than 30% of investment-grade straight bonds are callable.

Additional explanations for call provisions considered in the straight debt literature include reductions of hold-up problems (Smith and Warner, 1979) and of costs related to information asymmetries (Barnea, Haugen, and Senbet, 1980; Robbins and Schatzberg,

[12] There is disagreement in the literature about the relation between the level of interest rates and the probability of call provisions in straight debt issues. Unlike Kish and Livingston (1992) and Banko and Zhou (2010), studies by Sarkar (2003) and Booth, Gounopoulos, and Skinner (2013) report a negative relation between interest rates and call provision inclusion.

1986).[13] If the explanations for including a call provision in a straight debt issue are also important for convertibles, then we predict a common movement through time in the popularity of call provisions in convertible and straight debt. But to the extent that the preferences of convertible arbitrage hedge funds drive the recent change in the popularity of convertible bond call provisions, the decline in the incorporation of call provisions in the design of convertibles will not be mirrored by a similar decline for straight bonds.

We obtain data from Mergent FISD on the popularity of call provisions in U.S. issues of straight debt between 1985 and mid-2013. We delete issues by government and agency institutions as well as issues by banks and utilities, and observations with missing SIC codes. The resultant sample consists of 25,590 issues. Fig. 3 shows the percentage of straight debt issues in a year that are callable (upper chart) and the percentage that are callable within the first three years of their lives (lower chart) as well as the comparable percentages for convertible issues.

[please insert Fig. 3 here]

We observe very different time series behavior for the percentages of straight and convertible debt that are callable. The decreased incorporation of call provisions into the design of convertible bonds in the early years of the 21st century is not matched by a decrease in the popularity of straight debt call provisions.

As seen in Fig. 3, call provisions in straight debt issues declined in frequency in the late 1980s and then regained their popularity in the later part of the 1990s. Banko and Zhou (2010)

[13] For example, given an information asymmetry, a manager will wish to issue callable debt if she believes her firm to be of a higher quality than the market believes. A callable issue will allow the firm to signal its positive future prospects by being willing to pay a higher coupon than it would have to pay if the bond were non-callable in order to have the right to refinance when the manager's positive private information is revealed.

study trends in the popularity of call provisions in straight debt issues over the period 1980 through 2003. The authors conclude that the late 1980s decline is explained by the decline in interest rates from historically high levels in the 1970s and 1980s, which reduced the need for firms to hedge interest rate risk. Banko and Zhou (2010) also conclude that the subsequent rebound in the frequency of call provisions in the late 1990s coincides with the contemporaneous revival of the below investment-grade bond market.

At any point in time straight and convertible debt issues face the same interest rate environment. Hence, changes in rates cannot explain the difference in the patterns in Fig. 3. The difference in the patterns might potentially be explained by a time-varying difference between the proportions of below investment-grade straight debt and convertible debt issues. It might have been that the proportion of straight debt issues that were below investment-grade increased after 1990 (as Banko and Zhou (2010) observe) while the proportion of below investment-grade convertible issues declined dramatically after 2000. This, however, is not the case. The average fraction of rated convertibles with below investment-grade ratings issued over the years 1985 through 1999 inclusive is 75.15% and the post-1999 average is 77.62%.

For completeness, we separately examine the post-1999 change in the proportion of convertible issues callable within three years of issuance for investment-grade and for below investment-grade convertibles. The incorporation of call provisions in convertible issues declined irrespective of the convertible's rating. For below investment-grade convertibles, 77.45% of pre-2000 issues are callable within three years (91.27% contain call provisions) and this proportion declines to 26.08% (66.94%) after 1-1-2000. For investment-grade convertibles, 55.41% of pre-2000 issues are callable within three years (83.78% contain call provisions) and the proportion declines to 34.57% (78.72%) after 1-1-2000. For unrated convertibles, 76.27% of pre-2000 issues are callable within three years (82.78% contain call provisions) and the proportion declines to 30.47% (59.93%) after 1-1-2000.

5. Analysis of call provisions in convertible bond issues

The reduction in the popularity of call provisions allows us to examine the determinants of whether a particular issue is callable. This was not possible when call provisions were the effective default. In this and the following section, we report evidence that not only are the size of the convertible arbitrage industry and the fraction of an issue purchased by convertible arbitrageurs (i.e., measures of the influence of the preferences of capital suppliers) significant determinants of whether a convertible issue is callable, but proxies for information asymmetries, sequential financing, and potential hold-up problems (i.e., for measures of issuer preferences) also help explain whether a convertible is callable.

The dependent variable in our logit analysis is a dummy equal to one if the issue is callable within the first three years of its life and equal to zero if the issue is either call-protected for more than three years or simply does not contain a call provision. The independent variables are two variables related to convertibles arbitrage, namely the size of the convertible arbitrage industry and whether the convertible bond was a Rule 144A private placement, as well as a set of variables related to traditional rationales for including call provisions. Table 1 reports descriptive statistics for the variables in our analysis.

5.1. Variables related to convertible arbitrage

We use the aggregate end-of-year assets managed by convertible arbitrage hedge funds scaled by the outstanding balance of convertibles as a measure of the influence of the convertible arbitrage industry in our analyses of convertible bond design. We use the Live and Graveyard databases of Lipper TASS and HFR to calculate the size of the convertible arbitrage hedge fund industry as the aggregate end-of-year assets under management of all hedge funds

classified by Lipper TASS and/or HFR as convertible arbitrageurs.[14] Fig. 4 depicts the aggregate size of the convertible arbitrage industry over time. Since 2000, the aggregate size of the convertible arbitrage industry has exceeded 20 billion dollars.[15] Table 1 reports that on average during the years 1985 to 2013 convertible arbitrageurs held 22.33% of the outstanding market value of convertibles.

[please insert Table 1 and Fig. 4 here]

Table 1 also reports that approximately 48% of our main sample of convertible issues are privately placed in the 144A market. Securities issued under Rule 144A do not require registration with the SEC and can be traded without restriction in the secondary market by qualified institutional buyers.[16] In the private placement market potential buyers can influence security design through direct negotiation with the would-be issuer. Brown et al. (2012) note that hedge funds are especially active in the 144A market (see also Berkman, McKenzie, and Verwijmeren, 2017). If the preferences of hedge funds are important determinants of the design of convertible bonds in the 21st century, then we predict that the 144A issues will have a lower likelihood of being callable within three years of issuance.

5.2. Variables unrelated to convertible arbitrage

[14] We also classify a hedge fund in these databases as a convertible arbitrageur when the self-reported description of the hedge fund's strategy makes it clear that convertible arbitrage is an important part of the fund's strategy. We examine end-of-year assets under management because a substantial number of hedge funds do not report their assets under management on a monthly or quarterly basis.

[15] The aggregate size of the convertible arbitrage industry that we report exceeds the size reported by Choi, Getmansky, and Tookes (2009). An important reason for this difference is that we also include convertible arbitrage hedge funds that report in HFR. A comparison of Fig. 1 and 4 shows that the overall pattern is similar across both studies.

[16] Qualified institutional buyers have over $100 million in assets under management. Huang and Ramirez (2010) document that private placements of straight debt and convertible bonds became increasingly common during the 1991 through 2004 period.

Call provisions in the Stein (1992) model of convertible bond issuance and the Barnea, Haugen, and Senbet (1980) and Robbins and Schatzberg (1986) models of straight debt issuance arise because of asymmetric information between managers and investors. We use two variables to capture the level of information asymmetry. First, we include the size of the issuer as measured by total sales at the year-end before the issue. In doing so we follow Frank and Goyal (2003) and Bharath, Pasquariello, and Wu (2009), who argue that information asymmetries will be largest for small firms. The mean (median) sales by the issuers of our convertibles in the year prior to issue are $2,426 ($560) million.

Our second proxy for the level of information asymmetry is whether the issue is shelf registered. Shelf registration allows a firm to issue securities to the public without a separate prospectus for each issue and can be used by well-known seasoned issuers, defined by Securities Act Rule 405 as companies that have filed all annual and quarterly reports in a timely manner and that have a market capitalization of at least $700 million, or have issued at least $1 billion in registered debt offerings over the past three years. Firms that are able to issue securities via shelf registration are expected to be firms with relatively low information asymmetry. Table 1 reports that 17.31% of our sample are issued via a shelf registration.

Mayers (1998) argues that financing with callable convertibles can be optimal for firms requiring sequential rounds of financing. We use a firm's capex in the financial year before the issue scaled by total assets at the end of that prior year as a proxy for a firm's likely continuing financing requirements. The mean (median) prior year capex by the issuers of our convertibles is seven percent (four percent) of year-end total assets.

Interestingly, shelf registration, which we interpret as a proxy for information asymmetry, facilitates multiple financing rounds. As such, the sequential financing rationale would predict that shelf registrations are more likely to contain call provisions, whereas the

information asymmetry rationale predicts that shelf registrations are less likely to contain call provisions.

Smith and Warner (1979) argue that call provisions can facilitate the removal of restrictive covenants, for example in the case of a merger. We measure the perceived relevance of future takeovers at the time the security is designed by examining whether the security contains a poison put provision. Poison puts are relevant when there are potential takeovers since they allow the holders of a bond to sell it back to the issuer at a pre-specified price in the event of a change of control (Nanda and Yun, 1996). If the hold-up problem is important, then we predict that issues with poison put provisions, which reflect a heightened probability of a future takeover, will also include call provisions. Poison puts are contained in 44.7% of our sample.

Our analysis also includes the 10-year Treasury rate in the month of issue, whether the issue is investment-grade or below investment-grade, the number of years to maturity at the time of issue, and the offering proceeds. The majority of the convertibles in our sample are unrated, 10.57% have an investment-grade rating, and 30.74% are below investment-grade. The mean (median) number of years to maturity is 12.33 (9) and the mean (median) offering proceeds are $278 million ($150 million).

5.3. Univariate analysis of the determinants of convertible call provisions

Table 2 contains a univariate analysis of the relation between call provisions and the individual explanatory variables. Convertibles are significantly less likely to be callable within three years of issuance when the average size of the convertible arbitrage industry is larger and when the issue is privately-placed. Interest rates are significantly higher at times when convertibles callable within three years are issued than at times when convertibles that are not callable within three years are issued. Convertibles are significantly more likely to be callable

within three years of issue if the convertible contains a poison put provision. The average size of both the issuer and the issue is significantly larger, the time to maturity of the bond is significantly longer, and issuer capex is significantly lower if a convertible issue cannot be called within three years.

[please insert Table 2 here]

5.4. Logit analysis of the determinants of convertible call provisions

We use a logit model to examine the relation between the likelihood that a convertible is callable within three years of issuance and the size of the convertible arbitrage industry as a percentage of the outstanding balance of convertibles, whether the convertible was privately placed, a set of variables related to traditional rationales for including call provisions in debt issues, and industry fixed effects. Industry fixed effects are based on the Fama-French 12 industry classification.[17] Table 3 reports the results of the logit analysis with standard errors clustered by year.

[please insert Table 3 here]

The size of the convertible arbitrage hedge fund industry allows us to isolate an important and observable measure of capital supply in the convertible market. Model 1 of Table 3 shows that the size of the convertible arbitrage hedge fund industry is negatively related to the probability that a convertible can be called in the first three years. Privately-placed convertibles are also significantly less likely to be callable within three years. Both these results are in line with a strong influence of the supply side of capital on convertible security design.

In Model 1, a higher Treasury rate at the time of issue increases the probability that a convertible will be callable. An issue's rating does not have a significant effect on its callability. The maturity of the convertible is an important control variable. Convertibles with longer

[17] Our results are robust to using two-digit SIC codes.

maturities tend to have longer call protection periods and are thus less likely to be callable within three years of issuance.

Model 2 of Table 3 includes additional issue and issuer variables: whether the issue was shelf registered; whether the issue contained a poison put provision; the natural log of the issuer's total sales; and the issuer's capital expenditures as a percent of its total assets. These additional variables require information from Compustat and hence the sample size is reduced from 2,479 for our main sample to 1,853 for our restricted sample. Convertibles with a poison put provision are significantly more likely to be callable. Since a poison put provision is indicative of an increased perceived likelihood of a future change in control, we interpret this as evidence in favor of the hold-up rationale. We also find that smaller firms are more likely to issue callable convertibles. This is consistent with the backdoor equity rationale, which argues that settings with high information asymmetries are more likely to involve the issue of callable convertibles. Additionally, in line with the sequential financing rationale, firms with higher capex as a percentage of assets are more likely to issue callable convertibles.

The shelf registration variable has a negative coefficient, but is not statistically significant. Since firms that are able to issue securities via shelf registration are expected to have relatively low informational asymmetry, the negative coefficient is in line with the backdoor equity rationale. The strength of the relation may be reduced by the sequential financing rationale since shelf registration facilitates multiple financing rounds in which call provisions can play an important role (Mayers, 1998).

To further examine the importance of interest rates, we examine the link between callability and the fixed versus floating-rate nature of the coupon on a convertible issue. If the firm's managers predict a higher likelihood of a decline in interest rates than is predicted by buyers of the firm's debt and this divergence of opinions is larger when interest rates are higher, then call provisions in fixed-rate convertible bond issues will be more common when interest

rates are high. Such a disparity of views about interest rate variability will though not lead to the inclusion of call provisions in floating-rate issues. Model 3 of Table 3 extends Model 2 by including a floating-rate dummy and a cross-product of the floating-rate dummy and the 10-year Treasury-rate variable. Since the refinancing rationale for call provisions is moot when the debt pays a floating rate, we expect that the coefficient on the floating rate dummy should be negative. The estimated coefficient is negative but not statistically significant. Further, if the estimated coefficient on the interest rate variable is positive because the level of rates serves as a proxy for the importance of a disparity in issuer and purchaser predictions, then the sign of the coefficient on the cross-product term should be the opposite of that on the interest rate variable. The observed negative coefficient on the cross-product is in line with this prediction, but this effect is also not statistically significant. Overall, the results in Model 3 do not imply that interest rates are an important determinant of the likelihood that a convertible will be callable within three years of issuance.

Table 4 reports the marginal effects of the explanatory variables in the logit analysis. Consider the explanatory variable of primary interest, namely the size of the convertible arbitrage industry relative to the outstanding amount of convertibles. The standard deviation of the relative size of the convertible arbitrage industry across time in our sample is 15.4%. A one standard deviation increase in the size of the convertible arbitrage industry relative to the outstanding amount of convertibles from its mean value, holding constant all other variables at their respective mean values, reduces the likelihood of a convertible being callable within three years of issuance by the product of one standard deviation and the marginal effect; i.e., by approximately $0.154 \times 1.181 = 18.19\%$. The marginal effect associated with a dummy variable is the change in the likelihood that a convertible is callable if the dummy is equal to one rather than zero when all the other independent variables are equal to their means. Thus, privately-

placed convertibles are 12.1% less likely to be callable within three years of issuance than are publicly-placed convertibles.

[please insert Table 4 here]

5.5. Robustness

Table 5 reports the results of a number of robustness tests. Model 1 of Table 5 repeats the analysis in Model 2 of Table 3 with the difference being that standard errors are clustered by issuer rather by year. The statistical significance of our results is substantially increased when we cluster by issuer. For example, the standard error for our convertible arbitrage variable reduces from 1.945 to 0.908. In fact, untabulated analysis indicates that clustering by issuer provides standard errors that are not much higher than White standard errors, which suggests that the residuals are not heavily correlated for a given issuer across years, while the results for clustering by year indicate that there is substantial correlation of the residuals within a given year.

Model 2 of Table 5 uses the unscaled version of the size of the convertible arbitrage industry rather than the scaled version. We again find a significantly negative relation between the size of the hedge fund industry and the probability that a convertible will be callable within three years of issuance. Instead of focusing on the size of the convertible arbitrage industry, Model 3 of Table 5 examines the change in the scaled size of the convertible arbitrage industry during the year a convertible was issued. We again find a negative coefficient, but the associated *p*-value of 0.15 suggests that industry size is a better explanatory variable for call protection than the change in size.

As shown in Fig. 1 and 4, convertible arbitrage hedge funds became non-trivial suppliers of convertible bond capital only after 1994. Model 4 of Table 5 shows that the effect of the

convertible arbitrage industry is highly significant in the post-1994 period.[18] The significance of the Rule 144A private placement dummy in this period is again consistent with issuer and purchaser negotiations leading to a lower likelihood of a bond being callable within three years of issuance.

Rather than a measure of whether a convertible is protected from a call within the first three years of its life, we can instead use as the dependent variable a simple measure of whether or not a convertible contains a call provision. Model 5 of Table 5 shows that a larger convertible arbitrage industry is related to a reduced likelihood that a convertible will be callable. Further, as an alternate dependent variable Model 6 of Table 5 reports the results of a poisson regression where the dependent variable is the number of years for which the convertible is protected against a call.[19] This examination reduces the dependence on any particular cutoff such as the three years examined in earlier sections. Consistent with the preceding analyses, the size of the convertible arbitrage industry is significantly positively related to the length of call protection. The dependent variable in Model 7 is the number of years of call protection divided by the maturity of the bond. The relative call protection period is significantly longer when the size of the convertible arbitrage industry is larger, all else equal.

[please insert Table 5 here]

Endogeneity of the explanatory variables can affect the coefficient estimates in our tables. A firm may jointly decide on whether its convertible will be callable, the number of years to its maturity, whether it contains a poison put, and whether it is privately placed and/or shelf registered. We follow Korkeamaki and Moore (2004) and Tewari, Byrd, and Ramanlal

[18] A second rationale for separately examining this subperiod is that Booth, Gounopoulos, and Skinner (2013) report a potential selection bias in Mergent FISD data prior to 1995. Mergent FISD created its pre-1995 data by backdating. Hence, bonds issued after 1985 that ceased to exist before 1995 are not included in the FISD dataset.

[19] When the convertible is non-callable, the dependent variable is simply the bond's maturity.

(2015) and conduct endogeneity tests of the explanatory variables as described in Wooldridge (2002, Section 15.7.2). In the first step, we regress each of the potentially endogenous variables on the exogenous variables in our model and an additional variable. The exogenous variables are the preceding year's size of the convertible arbitrage industry, the Treasury rate, the issuer's rating, the offering proceeds, and the preceding year's total sales and capital expenditures. We use asset maturity as an additional determinant of the years to maturity (Stohs and Mauer, 1996). We use the firm's market leverage as an additional determinant of the inclusion of a poison put provision (Nanda and Yun, 1996). We use asset tangibility as an additional determinant of both private placement and shelf registration (Huang and Ramirez, 2010). The residuals from the first-step regression and the exogenous variables serve as explanatory variables in the second step, in which we estimate the probability that the convertible is callable within three years of issuance. In this second step, the test statistic for the coefficient of the residual provides a test of the null hypothesis of exogeneity of the instrumented variable. We cannot reject a null of exogeneity for any of the years to maturity, poison put provision, private placement, and shelf registration variables, with *z*-statistics of –0.09, 0.92, –0.15, and –0.08, respectively.

5.6. Are convertible arbitrage and call provisions related by chance?

A potential concern with the preceding analysis is that trends in convertible arbitrage and convertible bond callability might overlap by chance. To examine this possibility, we perform an untabulated collapsed analysis with the percentage of the convertible issues in a year that are callable within three years as the dependent variable and the relative size of the hedge fund industry at the prior year-end and a linear time trend control as the explanatory variables. The time trend control is calculated as the year of issue minus 1984. We use Newey-West standard

errors in this estimation as the Durbin-Watson statistic indicates significant autocorrelation.[20] Although there are only 29 annual observations, the size of the convertible arbitrage industry is significantly negatively related to the popularity of call provisions in this collapsed analysis. The time trend control is not statistically significant.

We perform a similar collapsed analysis in which we calculate the variables on a monthly basis. The resultant larger number of observations allow us to also include the monthly averages of our standard set of control variables in this specification. We again find a negative coefficient for the size of the convertible arbitrage industry and the relation is again statistically significant. Hence, the size of the convertible arbitrage industry is significantly and negatively related to the popularity of call provisions in a collapsed analysis that controls for a linear time trend, autocorrelation, and a set of control variables, all of which suggests that the time series do not simply line up by chance.

We can also control for the possibility that a common time trend explains the negative relation between callability and whether the issue is a private placement. The private placement dummy has cross-sectional variation and allows us to include year fixed effects in a logit analysis of the relation between callability and whether the issue is a private placement. Models 1 and 2 of Table 6 show that for both our main and restricted samples, privately-placed convertibles are significantly less likely to contain call provisions that allow for a call within three years even after controlling for year fixed effects.

[please insert Table 6 here]

6. Cross-sectional evidence on hedge fund involvement in specific issues

[20] We set the number of lags equal to the smallest integer equal to or greater than $T^{1/4}$ (Greene, 2012), where T is the maximum number of time periods. We have confirmed that our conclusion does not depend on a specific number of lags.

6.1. Hedge fund involvement in specific issues and the issue's callability

Brown et al. (2012) collect data on hedge fund involvement in privately-placed convertible offerings for the period 2000 through 2008 by downloading registration statements from SEC Edgar. For privately-placed issues, these registration statements contain the names of the buyers. This allows an analysis of the fraction of an issue placed with hedge funds. We follow their procedure to obtain information on hedge fund involvement in privately-placed convertible issues, but with two extensions. First, we extend the sample period to 1994 – 2013.[21] Second, we use PlacementTracker as an additional source of data on hedge fund involvement in specific security offerings. On average, hedge funds buy 53% of the 853 privately-placed convertibles for which we are able to obtain the names of the buyers.

[please insert Table 7 here]

Table 7 shows the relation between hedge fund involvement and the probability that a convertible is callable within the first three years of its life.[22] We predict that issues with relatively high hedge fund involvement are less likely to be callable within three years of issuance. Consistent with this prediction, we find a negative relation between the percentage of an issue purchased by hedge funds and the likelihood that the issue is callable within three years.

Using hedge fund involvement in a particular issue rather than the size of the convertible arbitrage industry as the explanatory variable has the disadvantage of a smaller sample size since the measure can only be accurately determined for privately-placed convertibles. However, the advantages of using hedge fund involvement in particular issues are that it is the

[21] 1994 is the first year for which we are able to find a registration statement with buyer information.

[22] We use a probit model in this section as this facilitates the two-stage least squares analysis reported in Section 6.2. Using a logit model to undertake an analysis like that reported in Table 7 provides qualitatively identical results.

cleaner measure of the explanatory variable and that the cross-sectional variation in hedge fund involvement allows us to control for year fixed effects in our regression specification. Model 3 and 4 of Table 7 show that including year fixed effects does not change our conclusion that issues with relatively high hedge fund involvement are less likely to be callable within three years.

6.2. Two-stage least squares analysis

In an unreported additional test, we use a two-stage model to obtain more insights into the link between the involvement of hedge funds and the convertible's call protection. The first-stage regression uses hedge fund involvement as the dependent variable and uses our set of control variables plus two additional variables as the explanatory variables. We select two additional variables that shift the likelihood that a convertible arbitrage fund participates in a convertible offering. The first additional variable is whether the offering is combined with a stock repurchase. The combination of a convertible offering and a stock repurchase (known as a "Happy Meal" to practitioners) facilitates hedge funds in obtaining their initial short positions, as the repurchase allows hedge funds to establish short positions at a predetermined price (De Jong, Dutordoir, and Verwijmeren, 2011). We set the "combined offering" dummy variable to one if the firm announces in either the SDC or Factiva databases that it uses part of the proceeds of the convertible issue to repurchase stock. The second additional variable is the Amihud illiquidity measure. The liquidity of the stock is important for convertible arbitrageurs as they adjust their short stock positions to remain delta-neutral and increased stock liquidity reduces the costs of establishing and maintaining a short position. The Amihud (2002) measure for illiquidity is the daily average of a firm's absolute return relative to the day's dollar volume during the window [–120, –20] compared to the convertible issue announcement date.

Our first-stage results indicate that hedge funds are more likely to be involved in combined offerings (this relation is statistically significant at the 5% level or better) and prefer liquid stock (this relation is not statistically significant). The second-stage results, in which the dependent variable is a dummy variable equal to one when the convertible can be called within three years, indicate that there is a significant negative relation between the fitted value of hedge fund involvement and the probability that the convertible can be called within three years. We find this relation both in a specification with and without year fixed effects. Although this evidence is suggestive of causation, any evidence on a causal link has to be interpreted with the appropriate caution. The design and marketing of a convertible bond are jointly determined and it is difficult to guarantee that the additional variables satisfy the exclusion restriction, in particular that no common omitted variables determine both whether a convertible is callable and whether it is issued in conjunction with a stock repurchase or the liquidity of the issuer's stock.

7. Offering discounts

With downward-sloping investor demand curves, an increase in the size of the convertible arbitrage industry potentially affects the pricing of convertibles. We calculate theoretical values of the convertibles in our sample at the time of their issue using a variant of the Tsiveriotis-Fernandes (1998) model, which has also been used by Ammann, Kim, and Wilde (2003), Chan and Chen (2005), Loncarski, ter Horst, and Veld (2009), and De Jong, Dutordoir, and Verwijmeren (2011) and which is argued to be the most popular convertible bond valuation method among practitioners (Zabolotnyuk, Jones, and Veld, 2010). The offering discount is the difference between the theoretical price and the offer price divided by the theoretical price. We limit our analysis to offering discounts between zero and 25 percent. Our theoretical price calculations use the following inputs: the risk-free interest rate (the yield

on U.S. Treasury Bills with a maturity as close as possible to the maturity of the convertible bond, obtained from Datastream); stock price; stock return volatility; coupon rate and coupon payment frequency; issue date, settlement date, and maturity date; dividend yield; information on the call provision; and the credit spread. The credit spread is based on the spreads on corporate industrial bonds with a maturity as close as possible to that of the convertible bond and the same Standard and Poor's (S&P) ratings as the newly issued convertible. In line with Loncarski, ter Horst, and Veld (2009) and De Jong, Dutordoir, and Verwijmeren (2011), we assign a BBB rating to unrated convertible issues. We obtain credit spreads from Datastream and the FRED database.

[please insert Table 8 here]

Table 8 reports the results of an analysis of the 877 convertible issues with information on offering discounts. The average offering discount in our sample is approximately 13%. The offering discount is the dependent variable and the explanatory variable of principal interest is an interaction term between the size of the hedge fund industry and whether the convertible is callable within three years. We predict that the increase in overall capital supply over time (due to convertible arbitrageurs) reduces the required offering discount for convertibles that are call-protected for at least three years, but not or to a lower extent for convertibles that can be called within three years.

In Model 1, we control for issue characteristics. In Model 2, we also include relevant issuer characteristics, such as the stock volatility and the market value of the issuer, which originate from earlier studies on offering costs (e.g., Corwin, 2003). Our second model includes 804 observations. We include industry fixed effects and standard errors are clustered by year in both models.

Our results indicate that the offering discount is negatively related to the size of the convertible arbitrage industry. A one standard deviation increase in the size of the convertible

arbitrage industry decreases the offering discount by about 1%, all else equal. Interestingly, the interaction effect between the size of the convertible arbitrage industry and whether a convertible can be called within three years is positive. The magnitude of this positive coefficient is similar to the negative coefficient for the convertible arbitrage industry variable. This result indicates that with the increasing size of the convertible arbitrage industry, the offering discount has reduced significantly less for convertibles that can be called within three years. In fact, the discounts for these convertibles are similar to the discounts that would have been observed before the increase in convertible arbitrage, all else equal.

8. Implications for the backdoor equity and sequential financing rationales

In the backdoor equity model of Stein (1992), call provisions are important since they allow a firm to force conversion into equity once the share price has risen. In Mayers (1998), call provisions are important since they allow firms to reduce their leverage by forcing conversion if the sequential investment option proves valuable. A reduction in the popularity of convertible call provisions might suggest that the backdoor equity and sequential financing models for convertible issuance have become less important in the 21st century. However, in both the Stein and Mayers models, short-term non-callable convertible debt can be a substitute for long-term callable convertible debt.[23] We therefore examine how the maturities of convertible bonds have varied through time in our sample. The median time to maturity at issuance of convertibles issued before 1990 and reported in the Mergent FISD dataset is 25

[23] In a world with long-term convertibles, the backdoor equity rationale for issuing a convertible could hold without call provisions if firms can induce voluntary conversion by paying sufficiently high dividends. However, Grundy and Verwijmeren (2016) show that voluntary conversion is never optimal for dividend-protected convertibles and document that dividend protection has become the default for convertible bonds.

years.[24] Since the early 1990s, however, the maturities of newly issued convertibles have decreased substantially, to eight years for the typical convertible issued in the 1990s and seven years for the typical convertible issued this century. In fact by 1995, when hedge funds started to implement convertible arbitrage, the typical maturity upon issuance had fallen to seven years. Hence, the recent diminution in the frequency of call provisions does not necessarily imply that the Stein (1992) and Mayers (1998) rationales for issuing convertibles are no longer important.

9. Conclusions

Consistent with the prediction of Baker (2009), we confirm the importance of the preferences of the suppliers of capital for the design of financing instruments. Convertible arbitrage hedge funds prefer to invest in convertibles that are not callable in the years immediately after issuance. We document that the popularity of convertible call provisions has declined substantially since the rise of convertible arbitrage. The world has changed from one in which almost all convertibles are callable to one in which the majority of convertible issues do not contain call provisions. We conclude that the change in convertible bond security design reflects the increased size of the convertible arbitrage industry and the increasing fraction of new convertibles issues purchased by hedge funds. Importantly, we show that the relation between convertible arbitrage hedge funds and whether convertibles contain call provisions remains strong after controlling for year fixed effects. A further observation consistent with the importance of a factor applicable to the convertible market but not the market for straight debt

[24] Convertible bonds that were issued after 1985 and ceased to exist before 1995 are not included in the Mergent FISD dataset (Booth, Gounopoulos, and Skinner, 2013). As a result, the average maturity of the pre-1995 issues in the Mergent database may be upward biased. We therefore also examine the set of bonds reported in the SDC database. We find that the typical maturity of convertible bonds issued before 1990 that are reported in the SDC database is 20 years.

issues is that there has been no contemporaneous decline in the popularity of call provisions in straight debt issues.

Our findings have potential implications for the future applicability of the extant rationales for issuing convertibles. The models in Green (1984), Brennan and Kraus (1987), Brennan and Schwartz (1988), Constantinides and Grundy (1989), and Brown et al. (2012) do not rely on call provisions being included, while the rationales of Stein (1992) and Mayers (1998) assign importance to call provisions. We note however that the shorter maturities of more recently issued convertible bonds could serve as a substitute for call provisions in the Stein and Mayers models.

The diminution in the frequency of call provisions in convertible debt issues but not their complete elimination allows for sufficient variation in convertible callability to analyze the importance of potential determinants of the inclusion of call provisions in convertible securities. This has not previously been empirically possible since call provisions were the default. In addition to the preferences of convertible arbitrageurs, other significant determinants of the inclusion of call provisions are their potential for reducing problems associated with information asymmetries, for facilitating sequential financing opportunities, and for reducing hold-up problems. Our study thus provides evidence of the interplay of supplier and issuer preferences in the design of securities.

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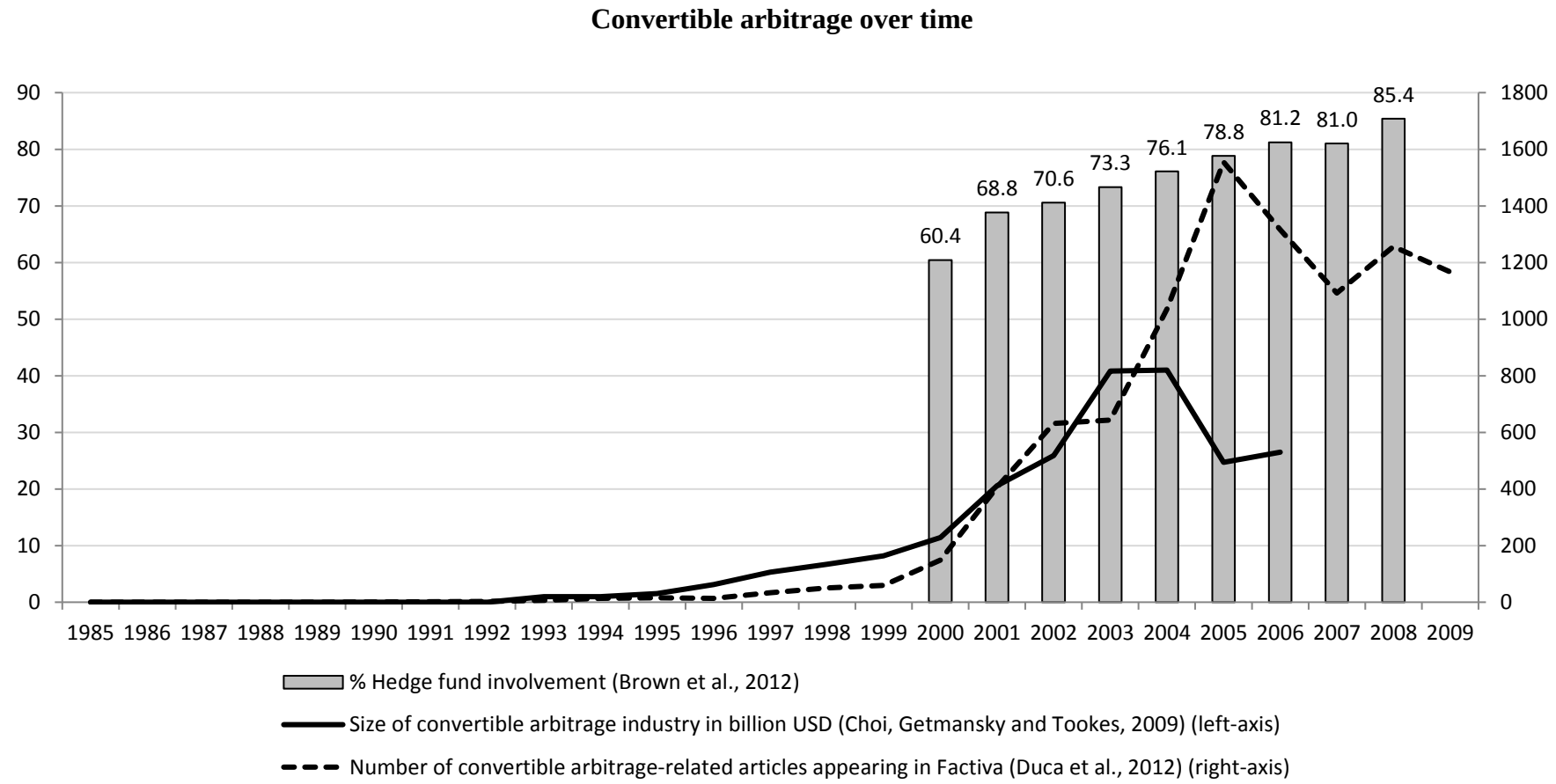

Fig. 1.
This figure depicts measures of convertible fund activity through time: the annual percentage of privately-placed convertible bonds that are purchased by hedge funds, from Brown et al. (2012), above the columns; the end-of-year total assets of convertible arbitrage hedge funds in billions of USD, from Choi, Getmansky, and Tookes (2009), on the left axis; and the annual number of press articles in Factiva about convertible arbitrage, from Duca et al. (2012), on the right axis.

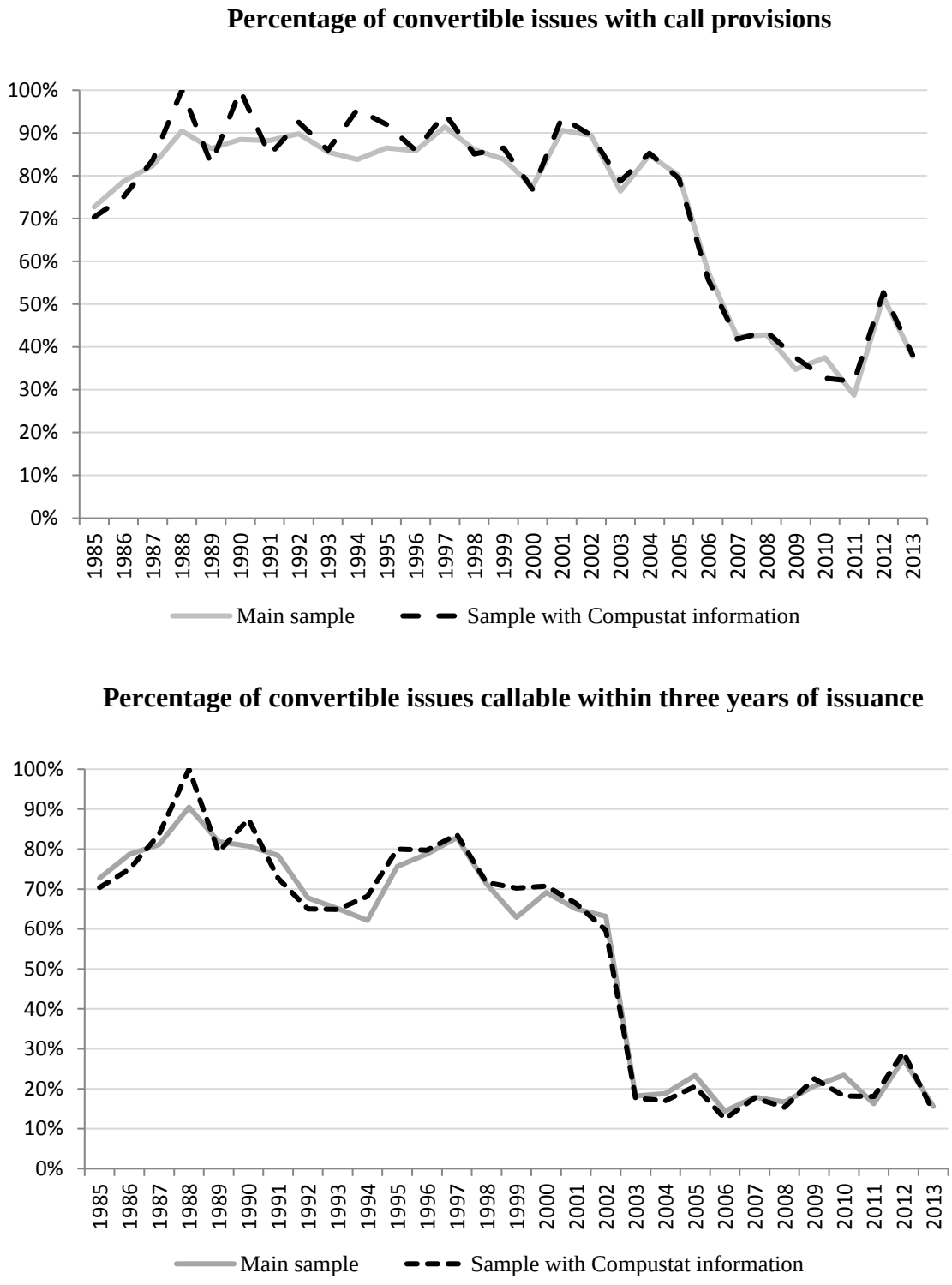

Fig. 2.

This figure reports the fraction of convertibles issued between January 1985 and July 2013 that are callable (upper chart) and the fraction of convertible issues that are callable within three years of issuance (lower chart). Our main sample consists of convertible bonds issued by U.S. industrial firms. Our restricted sample imposes the requirement that the issuer reports information in Compustat in the year before the issue.

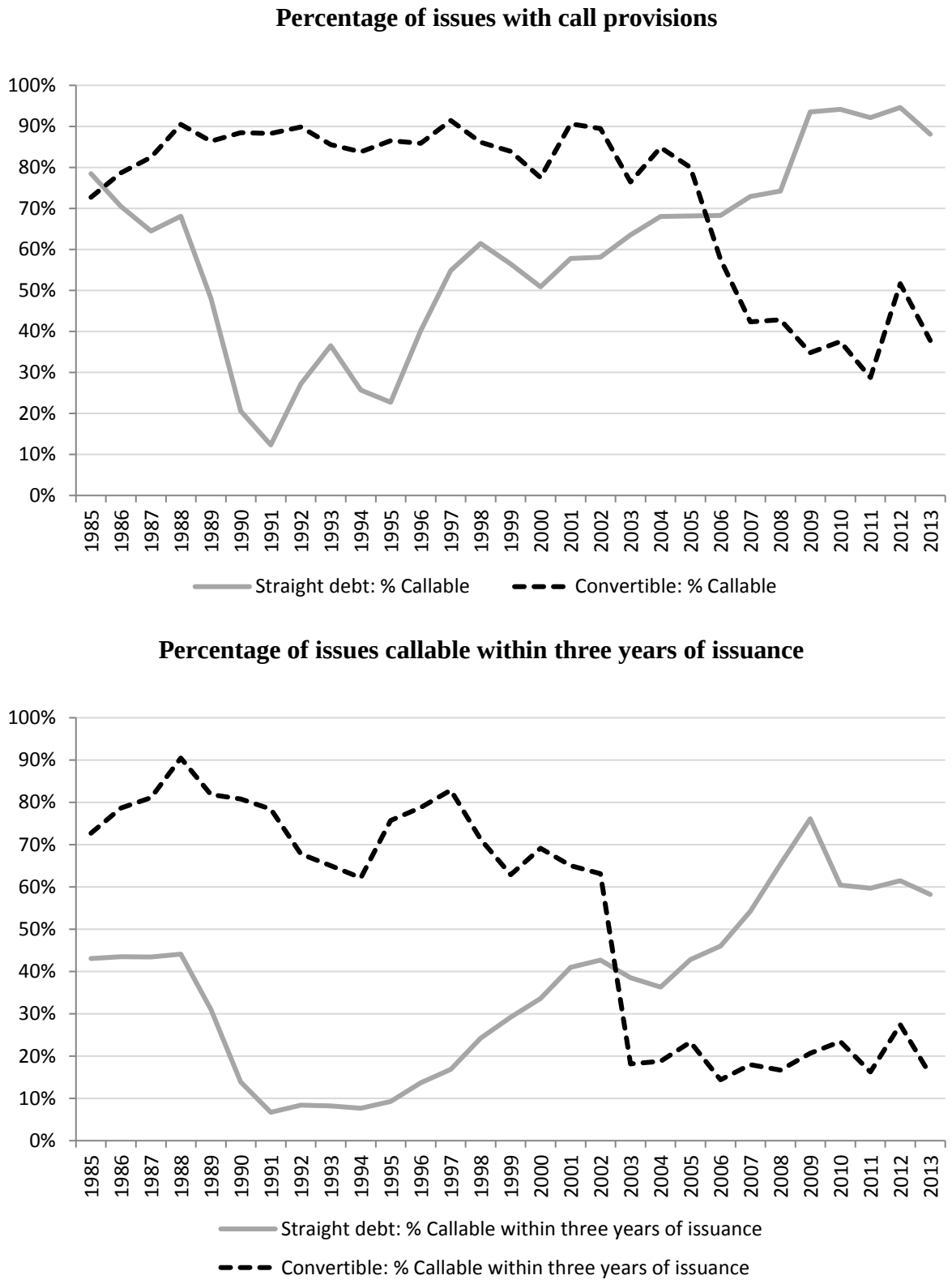

Fig. 3.

This figure reports the fractions of straight debt and convertibles issued between January 1985 and July 2013 that are callable (upper chart) and the fractions of straight debt and convertible issues that are callable within three years of issuance (lower chart).

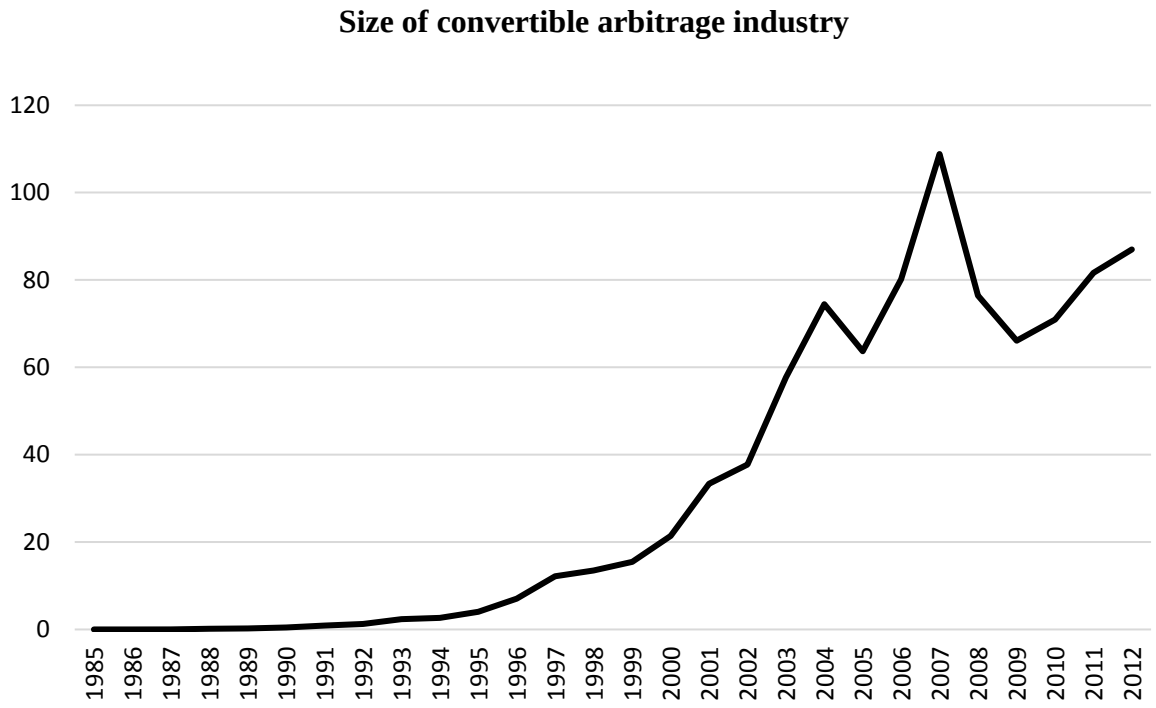

Fig. 4.

This figure depicts the aggregate end-of-year total assets of convertible arbitrage hedge funds that report in Lipper TASS and/or HFR, in billions of USD.

Table 1. Descriptive statistics

This table presents descriptive statistics for convertible issues during the years 1985 to 2013. Convertible arbitrage (unscaled) is the aggregate AUM in billions of U.S. dollars of convertible arbitrage hedge funds at the year-end before the convertible issue, from Lipper TASS and HFR. The "Convertible arbitrage" variable is the aggregate AUM of convertible arbitrage hedge funds scaled by the outstanding balance of convertibles. The outstanding balance of convertibles at the year-end before the convertible issue is the total market value of outstanding U.S. convertibles obtained from BofA Merrill Lynch. Issue characteristics are based on information from Mergent FISD. Callable within three years of issuance is a dummy equal to one if the convertible contains a call provision and is not call-protected for more than three years, and zero otherwise. 144A private placement is a dummy equal to one if the convertible is privately placed under Rule 144A, and zero otherwise. The 10 year Treasury rate is the monthly 10 year Treasury rate at the time of issue, reported in percent. Below investment-grade rating is a dummy equal to one for below investment-grade convertibles and zero for investment-grade and unrated issues. Investment-grade rating is a dummy equal to one for investment-grade convertibles and zero for below investment-grade and unrated issues. Years to maturity are the number of years between issuance and maturity. Offering proceeds are the gross proceeds in millions of dollars. Shelf registration is a dummy equal to one if the convertible is shelf registered, and zero otherwise. Poison put provision is a dummy equal to one if the convertible contains a poison put provision, and zero otherwise. A poison put provision allows the holder of the convertible to sell the security back to the firm in the event of a change in control. Total sales are the issuer's reported sales in millions in the financial year preceding the issue as reported in Compustat. Capex as a percent of assets is the issuer's capital expenditures during the financial year preceding the issue scaled by total assets at the end of that year as reported in Compustat.

	N	Mean	Median	St.dev.
Convertible arbitrage (unscaled)	2479	37.22	33.32	32.74
Outstanding balance of convertibles	2479	124.83	142.41	80.33
Convertible arbitrage	2479	22.33%	21.15%	15.18%
Callable within three years of issuance	2479	46.39%		
144A Private placement	2479	47.96%		
10 year Treasury rate	2479	5.24	4.99	1.79
Below investment-grade rating	2479	30.74%		
Investment-grade rating	2479	10.57%		
Years to maturity	2479	12.33	9.00	8.05
Offering proceeds	2479	278	150	418
Shelf registration	2479	17.31%		
Poison put provision	2479	44.70%		
Total sales	1895	2426	560	7873
Capex as a percent of assets	1875	0.07	0.04	0.09

Table 2. Univariate analysis

This table presents a univariate analysis of the distinction between convertibles that are callable with three years of issuance and convertibles that are not callable in the first three years of their lives. See Table 1 for a description of the variables. For dummy variables we calculate whether the difference between two proportions is significant using a two-proportion *z*-test. For the other variables we calculate difference of means *t*-statistics with a *t*-test that does not assume equal variances. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

	Callable within three years of issuance		Difference of means statistic
	No	Yes	
Convertible arbitrage (unscaled)	52.12	19.99	28.23***
Convertible arbitrage	28.54%	15.16%	24.46***
144A Private placement	61.93%	31.83%	14.96***
10-year Treasury rate	4.50	6.08	–24.14***
Below investment-grade rating	31.75%	29.57%	1.18
Investment-grade rating	11.74%	9.22%	2.04**
Years to maturity	13.08	11.45	5.07***
Offering proceeds	327	221	6.53***
Shelf registration	18.43%	16.00%	1.60
Poison put provision	37.02%	53.57%	–8.26***
Total sales	3026	1637	4.12***
Capex as a percent of assets	0.06	0.09	–6.39***

Table 3. Logit analysis of the determinants of call provisions

The Table reports a logit analysis of convertible bond issues during the period 1985 – 2013. The dependent variable is a dummy equal to one if the convertible is callable within three years of issuance, and zero otherwise. See Table 1 for a description of the independent variables. Log of offering proceeds is the logarithm of the gross proceeds in thousands of dollars. Log of total sales is the logarithm of the issuer's total sales in millions of dollars in the financial year preceding the issue as reported in Compustat. The floating rate measure is a dummy equal to one if the convertible pays a floating coupon rate, and zero otherwise. Heteroskedasticity-consistent standard errors clustered by year are reported in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

	Callable within three years of issuance		
	(1)	(2)	(3)
Convertible arbitrage	–4.938***	–4.907**	–5.019***
	(1.698)	(1.945)	(1.878)
144A Private placement	–0.750***	–0.504*	–0.504*
	(0.154)	(0.289)	(0.290)
10-year Treasury rate	0.258*	0.248	0.243
	(0.153)	(0.152)	(0.150)
Below investment-grade rating	0.030	0.097	0.079
	(0.133)	(0.155)	(0.156)
Investment-grade rating	0.077	0.074	0.110
	(0.321)	(0.334)	(0.331)
Log of years to maturity	–0.852***	–0.763***	–0.728***
	(0.171)	(0.183)	(0.170)
Log of offering proceeds	–0.101	–0.058	–0.032
	(0.114)	(0.106)	(0.118)
Shelf registration		–0.252	–0.240
		(0.257)	(0.255)
Poison put provision		0.493**	0.501**
		(0.203)	(0.204)
Log of total sales		–0.116**	–0.117**
		(0.048)	(0.047)
Capex as a percent of assets		1.689***	1.679***
		(0.581)	(0.576)
Floating rate			–0.094
			(0.945)
10-year Treasury rate × floating rate			–0.035
			(0.174)
Industry fixed effects	Yes	Yes	Yes
N	2479	1853	1853
McFadden Pseudo R^2	0.23	0.24	0.24

Table 4. Marginal effects in the logit analysis of the determinants of call provisions
Marginal effects in the logit analysis of Model 2 of Table 3 of the likelihood that a convertible bond issued during the period 1985 – 2013 will be callable within three years of issuance. See Tables 1 and 3 for a description of the independent variables. The standard deviations are calculated using the 1853 observations included in the logit analysis.

	Callable within three years of issuance		
	Marginal effects	Standard deviation	Product
Convertible arbitrage	–1.181	0.154	–18.19%
144A Private placement	–0.121		
10-year Treasury rate	0.060	1.757	10.54%
Below investment-grade rating	0.023		
Investment-grade rating	0.018		
Log of years to maturity	–0.184	0.671	–12.35%
Log of offering proceeds	–0.014	1.061	–1.49%
Shelf registration	–0.060		
Poison put provision	0.119		
Log of total sales	–0.028	1.986	–5.56%
Capex as a percent of total assets	0.407	0.092	3.74%
Industry fixed effects	Yes		
N	1853		

Table 5. Robustness tests

Models 1 – 4 of this Table report a logit analysis of convertible bond issues in which the dependent variable is a dummy equal to one if the convertible is callable within three years of issuance, and zero otherwise. The sample in Models 1 – 3 consist of convertible bond issues during the period 1985 – 2013 and in Model 4 during the period 1995 – 2013. Model 5 of this table reports a logit analysis of convertible bond issues in which the dependent variable is a dummy equal to one if the convertible is callable, and zero otherwise. Model 6 of this table reports the results of a poisson model of the length of the call protection period in years for convertibles issued. Model 7 reports an ordinary least squares estimation of the ratio of a convertible's call protection period over its years to maturity. See Table 1 and 3 for a description of most of the independent variables. The change in convertible arbitrage is the change in the size of the convertible arbitrage industry as compared to the balance of convertibles in the year of the offering. In Models 2 – 7, heteroskedasticity-consistent standard errors clustered by year are reported in parentheses, whereas the standard errors are clustered by issuer in Model 1. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

	Callable within three years of issuance				Callable	Call protection period	Call protection period ÷ maturity
				Post-1994			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Convertible arbitrage	–4.907***			–5.087**	–7.255***	1.170***	0.696***
	(0.908)			(2.452)	(1.910)	(0.415)	(0.176)
Convertible arbitrage (unscaled)		–3.201***					
		(0.579)					
Change in convertible arbitrage			–3.403				
			(2.377)				
144A Private placement	–0.504***	–0.448*	–0.543**	–0.689**	–0.226	0.145*	0.053
	(0.164)	(0.270)	(0.267)	(0.314)	(0.348)	(0.077)	(0.035)
10-year Treasury rate	0.248***	0.139	0.605***	0.375*	–0.334*	0.019	0.014
	(0.075)	(0.112)	(0.094)	(0.203)	(0.184)	(0.041)	(0.016)
Below investment-grade rating	0.097	–0.101	0.181	0.155	0.367	0.062	–0.005
	(0.124)	(0.151)	(0.161)	(0.170)	(0.234)	(0.062)	(0.022)
Investment-grade rating	0.074	–0.234	0.181	0.545*	0.493*	–0.093	–0.041
	(0.246)	(0.309)	(0.351)	(0.286)	(0.294)	(0.096)	(0.032)
Log of years to maturity	–0.763***				1.744***	0.310***	
		–0.677***	–0.655***	–0.762***	(0.233)	(0.034)	–0.285***

	(0.099)	(0.177)	(0.172)	(0.205)			(0.021)
Log of offering proceeds	–0.058	–0.092	–0.068	–0.250**	–0.103	–0.016	0.007
	(0.079)	(0.106)	(0.103)	(0.099)	(0.158)	(0.042)	(0.017)
Shelf registration	–0.252	–0.260	–0.367	–0.252	–0.038	0.118*	0.028
	(0.175)	(0.215)	(0.263)	(0.292)	(0.295)	(0.067)	(0.031)
Poison put provision	0.493***	0.628***	0.406*	0.293	0.962***	–0.282***	–0.093***
	(0.145)	(0.181)	(0.215)	(0.231)	(0.308)	(0.093)	(0.031)
Log of total sales	–0.116***	–0.105**	–0.154***	–0.100*	–0.102**	0.021	0.014**
	(0.038)	(0.041)	(0.050)	(0.060)	(0.052)	(0.014)	(0.007)
Capex as a percent of assets	1.689**	1.532***	1.574***	2.287***	0.594	–0.305	–0.085
	(0.729)	(0.572)	(0.577)	(0.664)	(0.729)	(0.233)	(0.074)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standard errors clustered by	Issuer	Year	Year	Year	Year	Year	Year
N	1853	1853	1853	1514	1853	1853	1853
McFadden Pseudo R^2	0.24	0.28	0.24	0.23	0.27	0.07	
R^2							0.42

Table 6. Private placements and year fixed effects

The Table reports a logit analysis of convertible bond issues during the period 1985 – 2013. The dependent variable is a dummy equal to one if the convertible is callable within three years of issuance, and zero otherwise. See Table 1 and 3 for a description of the independent variables. Heteroskedasticity-consistent standard errors clustered by year are reported in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

	Callable within three years of issuance	
	(1)	(2)
144A Private placement	–0.957***	–0.639***
	(0.111)	(0.240)
10-year Treasury rate	0.361**	0.388**
	(0.142)	(0.184)
Below investment-grade rating	–0.173	–0.184
	(0.150)	(0.184)
Investment-grade rating	–0.447*	–0.469*
	(0.252)	(0.284)
Log of years to maturity	–0.622***	–0.627***
	(0.174)	(0.210)
Log of offering proceeds	–0.199	–0.163
	(0.121)	(0.128)
Shelf registration		–0.508**
		(0.234)
Poison put provision		0.788***
		(0.222)
Log of total sales		–0.090**
		(0.042)
Capex as a percent of assets		1.399**
		(0.590)
Industry fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
N	2479	1853
McFadden Pseudo R^2	0.29	0.31

Table 7. Hedge fund involvement

The Table reports the results of a probit analysis of privately-placed convertible bond issues by industrial firms during the period 1985 – 2013. The dependent variable is a dummy equal to one if the convertible is callable within three years of issuance, and zero otherwise. Hedge fund involvement is the percentage of the convertible issue purchased by hedge funds. See Table 1 and 3 for a description of the other independent variables. Heteroskedasticity-consistent standard errors clustered by year are reported in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

	Callable within three years of issuance			
	(1)	(2)	(3)	(4)
Hedge fund involvement	–1.044***	–1.077***	–1.134***	–1.276***
	(0.326)	(0.380)	(0.276)	(0.643)
10-year Treasury rate	0.464***	0.420***	0.386***	0.309***
	(0.051)	(0.073)	(0.076)	(0.094)
Below investment-grade rating	0.044	0.135	–0.127	–0.040
	(0.088)	(0.093)	(0.112)	(0.108)
Investment-grade rating	0.354*	0.379*	0.058	0.034
	(0.203)	(0.195)	(0.241)	(0.219)
Log of years to maturity	–0.593***	–0.481**	–0.542***	–0.431**
	(0.186)	(0.206)	(0.171)	(0.204)
Log of offering proceeds	–0.184*	–0.030	–0.223**	–0.086
	(0.096)	(0.087)	(0.091)	(0.103)
Shelf registration		–0.011		–0.122
		(0.280)		(0.253)
Poison put provision		–0.039		0.315
		(0.244)		(0.202)
Log of total sales		–0.113*		–0.102*
		(0.061)		(0.060)
Capex as a percent of assets		2.268**		1.501
		(0.989)		(0.937)
Industry fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	No	No	Yes	Yes
N	853	711	853	711
McFadden Pseudo R^2	0.26	0.25	0.32	0.32

Table 8. Offering discount

The Table reports an ordinary least squares estimation of convertible bond offering discounts. The dependent variable is the offering discount, calculated with the Tsiveriotis-Fernandes (1998) model. See Table 1 and 3 for a description of the issue characteristics and convertible arbitrage variable. Stock volatility is the daily stock return volatility calculated from stock returns over the window [-240, -40] relative to the convertible issue announcement date. The log of market value is the logarithm of the issuer's total market value in millions of dollars in the financial year preceding the issue. The Amihud illiquidity measure is calculated as the daily average of a firm's absolute return relative to the day's dollar volume during the window [-120, -20] compared to the convertible issue announcement date. Dividend-paying is a dummy equal to one if the firm pays a dividend in the financial year preceding the issue, and zero otherwise. Book leverage is calculated as total debt over assets in the financial year preceding the issue. Heteroskedasticity-consistent standard errors clustered at the year level are reported in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level.

	Offering discount	
	(1)	(2)
Convertible arbitrage	–0.068*	–0.078**
	(0.039)	(0.032)
Callable within three years of issuance × Convertible arbitrage	0.073*	0.083*
	(0.040)	(0.048)
Callable within three years of issuance	–0.014	–0.022
	(0.016)	(0.015)
144A Private placement	0.009	0.011
	(0.007)	(0.007)
Below investment-grade rating	–0.004	–0.008
	(0.005)	(0.005)
Investment-grade rating	–0.014	–0.005
	(0.010)	(0.009)
Log of years to maturity	–0.015**	–0.014*
	(0.006)	(0.006)
Log of offering proceeds	–0.006	0.006
	(0.004)	(0.004)
Shelf registration	–0.004	0.006
	(0.007)	(0.007)
Poison put provision	0.010	0.016**
	(0.008)	(0.007)
Stock volatility		0.058**
		(0.024)
Log of market value		–0.006*
		(0.003)
Amihud illiquidity measure		0.002***
		(0.001)
Dividend-paying		–0.014*
		(0.008)
Book leverage		0.003
		(0.008)
Industry fixed effects	Yes	Yes
N	877	804
McFadden Pseudo R^2	0.06	0.13